REMARKS

In view of the above amendments and the following remarks, reconsideration of the outstanding office action is respectfully requested.

Applicants gratefully acknowledge the undersigned's opportunity to interview with Examiner Berman on July 25, 2003. The following remarks summarize the presentation of the undersigned on the applicants' behalf during the interview.

The objection under 35 U.S.C. §132 for the introduction of new matter is respectfully traversed in view of the above amendments.

The rejection of claims 20 and 23 under 35 U.S.C. § 112, second paragraph, for indefiniteness is improper and should be withdrawn in view of the November 25, 2002, amendment, deleting "electron" in claim 20 and replacing "step b)" with "step a)" in claim 23.

The rejection of claims 15, 17, 19, 20, 23, 24, and 29-31 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,028,332 to Ohnishi et al. ("Ohnishi") is respectfully traversed in view of the above amendments and the following remarks. Support for the amendments to claims 15, 17, 19, 20, 22, and 31 is found, for example, at page 6, lines 9-14, page 10, line 7 to page 12, line 12, and page 13, line 5 to page 15, line 24 of the specification of the above-identified application.

Ohnishi relates to a method of manufacturing a hydrophilic material, the resulting material, and its use for porous membranes. The method involves subjecting at least part of the surfaces of a membrane substrate of a polymer material to a plasma treatment to thereby produce a polymer radical on the surfaces and graft polymerizing with the polymer radical a block copolymer containing a hydrophilic monomer supplied in the gaseous phase and a subsequently supplied hydrophobic monomer.

In contrast, amended claim 15 (and its dependent claims 8, 17, and 19-30) is directed to "[a] method for providing hydrophilicity or increased hydrophobicity to the surface of a polymer membrane comprising: a) inserting a polymer membrane into a vacuum chamber and irradiating the surface of the polymer membrane with an ionic beam under a high vacuum, said ionic beam being generated by selectively deriving positively charged ionic particles from an ion source and accelerating the ionic particles with energy; and b) treating the surface-activated polymer membrane obtained in step a) by infusing a reactive gas onto the surface of the polymer membrane to cause reaction of the gas with the polymer membrane surface, wherein the ionic beam irradiation of step a) and reactive gas infusion of

step b) are sequentially made" and amended claim 31 is directed to "[a] method for providing hydrophilicity or increased hydrophobicity to the surface of a polymer comprising: a) inserting a polymer into a vacuum chamber and irradiating the surface of the polymer with an ionic beam under high vacuum, said ionic beam being generated by selectively deriving positively charged ionic particles from an ion source and accelerating the ionic particles with energy; and b) treating the surface-activated polymer obtained in step a) by infusing a reactive gas onto the surface of the polymer to cause reaction of the gas with the polymer surface, wherein the ionic beam irradiation of step a) and reactive gas infusion of step b) are sequentially made."

Ohnishi neither discloses nor suggests a method for providing hydrophilicity or increased hydrophobicity to the surface of a polymer membrane or polymer which includes irradiating the surface of the polymer membrane or polymer with an ionic beam generated by selectively deriving positively charged ionic particles from an ion source and accelerating the ionic particles with energy, as required by claims 8, 15, 17, and 19-31 of the present application. In contrast, Ohnishi discloses subjecting the surface of a polymer material to a plasma treatment, which, as set forth at page 4 of the outstanding office action, includes both positive ions and electrons. In contrast to the method of the present invention, the use of a plasma, as disclosed in Ohnishi, leads to problems in control of uniformity due to plasma's inherent characteristics of high dependence on external environmental factors, broad energy distribution, etc., and enhanced potential for mechanical surface damage due to other side reactions degrading mechanical properties (see, e.g., Specification at page 3, line 29 to page 4, line 4). Moreover, plasma is "an electrically conducting medium in which there are roughly equal numbers of positively and negatively charged particles, produced when the atoms in a gas become ionized" (see http://www.britannica.com). In the plasma, various kinds of ions, neutral atoms, radicals, and neutral particles exits together with photons. Thus, in plasma treatment, electrons, neutral gas particles, and ions interact with the surface of the polymer membrane causing physical and chemical reactions. In addition, with plasma treatment, secondary-emission of electrons ("delta process") occurs. Thus, the plasma treatment process is different in terms of reaction patterns and reactants than treatment with an ionic beam generated by selectively deriving positively charged ionic particles from an ion source in accordance with the present invention.

Therefore, the rejection based on this reference is improper and should be withdrawn.

The rejection of claims 15, 17, 19, 20, 23, 24, 27, and 29-31 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,845,132 to Masuoka et al. ("Masuoka") is respectfully traversed in view of the above amendments and the following remarks.

Masuoka teaches a hydrophilic porous membrane, a plasma separator using the hydrophilic porous membrane, and a method of producing a hydrophilic porous membrane by irradiating the outer surface of a hydrophobic porous membrane with plasma, feeding hydrophilic monomer in a gaseous state, and allowing the hydrophilic monomer to be graft polymerized on the surface of the porous membrane. Masuoka teaches that the hydrophilic porous membrane exhibits prominent dimensional stability and strength while in use, and discloses a blood plasma separator that uses the hydrophilic porous membrane.

In contrast, amended claim 15 (and its dependent claims 8, 17, and 19-30) is directed to "[a] method for providing hydrophilicity or increased hydrophobicity to the surface of a polymer membrane comprising: a) inserting a polymer membrane into a vacuum chamber and irradiating the surface of the polymer membrane with an ionic beam under a high vacuum, said ionic beam being generated by selectively deriving positively charged ionic particles from an ion source and accelerating the ionic particles with energy; and b) treating the surface-activated polymer membrane obtained in step a) by infusing a reactive gas onto the surface of the polymer membrane to cause reaction of the gas with the polymer membrane surface, wherein the ionic beam irradiation of step a) and reactive gas infusion of step b) are sequentially made" and amended claim 31 is directed to "[a] method for providing hydrophilicity or increased hydrophobicity to the surface of a polymer comprising: a) inserting a polymer into a vacuum chamber and irradiating the surface of the polymer with an ionic beam under high vacuum, said ionic beam being generated by selectively deriving positively charged ionic particles from an ion source and accelerating the ionic particles with energy; and b) treating the surface-activated polymer obtained in step a) by infusing a reactive gas onto the surface of the polymer to cause reaction of the gas with the polymer surface, wherein the ionic beam irradiation of step a) and reactive gas infusion of step b) are sequentially made."

Masuoka neither discloses nor suggests a method for providing hydrophilicity or increased hydrophobicity to the surface of a polymer membrane or polymer which includes irradiating the surface of the polymer membrane or polymer with an ionic beam generated by selectively deriving positively charged ionic particles from an ion source and accelerating the ionic particles with energy, as required by the claims of the present application. In contrast, Masuoka discloses irradiating a hydrophobic porous membrane with

plasma, which, as set forth at page 4 of the outstanding office action, includes both positive ions and electrons. In contrast to the method of the present invention and as described above, the use of a plasma, as disclosed in Masuoka, leads to problems in control of uniformity due to plasma's inherent characteristics of high dependence on external environmental factors, broad energy distribution, etc., and potential for mechanical surface damage due to other side reactions degrading mechanical properties (see, e.g., Specification at page 3, line to page 4, line 4) and is different in terms of reaction patterns and reactants than treatment with an ionic beam generated by selectively deriving positively charged ionic particles from an ion source in accordance with the present invention.

Therefore, the rejection based on this reference is improper and should be withdrawn.

The rejection of claims 15, 17, 19-25, and 27-31 under 35 U.S.C. § 103(a) as being unpatentable over Masuoka is respectfully traversed in view of the above remarks.

The rejection of claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Masuoka in view of U.S. Patent No. 4,346,142 to Lazear ("Lazear") is respectfully traversed in view of the following remarks.

Lazear discloses a process for rendering a normally hydrophobic polyolefinic open cell microporous film relatively permanently hydrophilic, improving the water flow rate there through, and reducing the electrical resistance thereof by chemically fixing a controlled amount of at least one hydrophilic organic hydrocarbon monomer to the surface of the micropores of the film with ionizing radiation. In particular, Lazear discloses coating the surface of the micropores of the microporous film with a hydrophilic monomer or mixture thereof, and subsequently exposing the coated microporous film to ionizing radiation.

A proper *prima facie* showing of obviousness requires the PTO to show that the prior art relied upon, coupled with the knowledge generally available to one of ordinary skill in the art, contains some suggestion which would have motivated the skilled artisan to combine or modify references. See In re Fine, 837 F.2d. 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988).

Lazear does not disclose a sequential process including first irradiating a polymer/polymer membrane surface with an ionic beam generated by selectively deriving positively charged ionic particles from an ion source and accelerating the ionic particles with energy and then infusing a reactive gas onto the surface of the polymer/polymer membrane, as required by claim 8. In contrast, Lazear specifically discloses first coating a microporous film with a hydrophilic monomer, and subsequently exposing the coated microporous film to

ionizing radiation. As described above, Masuoka teaches first irradiating a polymer membrane with a plasma and then feeding a hydrophilic monomer in a gaseous state. Thus, there is no suggestion or motivation to combine the references found in the references themselves or in the state of the art. The only basis for the combination of a sequential process including first irradiating a polymer/polymer membrane surface with an ionic beam generated by selectively deriving positively charged ionic particles from an ion source and accelerating the ionic particles with energy and then infusing a reactive gas onto the surface of the polymer/polymer membrane is applicants' combination of these elements. Therefore, this rejection is improper and should be withdrawn.

The rejection of claims 15, 17, 19-26, and 29-31 under 35 U.S.C. § 103(a) as being unpatentable over Korean Laid-Open Patent Publication No. 96-37742 ("Publication No. 96-37742"), as discussed on page 4 of the specification, in view of Ohnishi or Masuoka is respectfully traversed in view of the above amendments and the following remarks.

Publication No. 96-37742, as described at page 4 of the specification, relates to a method for reforming a polymer surface by irradiating it with energized ion particles under vacuum conditions while at the same time infusing reactive gas into the polymer surface.

It is the position of the U.S. Patent and Trademark Office ("PTO") that Publication No. 96-37742 teaches the method steps of the present invention, but does not specifically mention treating polymer membranes, polyolefin blends, or laminates. However, the PTO argues that it would have been obvious to one skilled in the art to employ polymers in the form of polymeric membranes, as disclosed by Ohnishi and Masuoka, as the polymer to be treated in the process disclosed by Publication No. 96-37742. Moreover, the PTO argues that it would have been obvious to treat the irradiated polymeric surface in Publication No. 96-37742 with a gaseous monomer after irradiation (sequentially), as taught by Ohnishi or by Masuoka, instead of simultaneously, as disclosed by Publication No. 96-37742. Applicants respectfully disagree.

As described above, a proper *prima facie* showing of obviousness requires the PTO to show that the prior art relied upon, coupled with the knowledge generally available to one of ordinary skill in the art, contains some suggestion which would have motivated the skilled artisan to combine or modify references. See In re Fine, 837 F.2d. 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988).

There is no suggestion or motivation in the above-noted references to combine the disclosure of Publication No. 96-37742, which specifically discloses irradiating a polymer

surface with energized ion particles while at the same time infusing reactive gas into the polymer surface, with Ohnishi or Masuoka which disclose irradiating a polymer membrane surface with a plasma and then supplying a gaseous hydrophilic monomer for graft polymerization. The PTO's position is that it would have been obvious to treat the irradiated polymeric surface of Publication No. 96-37742 with a gaseous monomer after irradiation (sequentially) in view of Ohnishi and Masuoka and that Ohnishi provides motivation by teaching that the disclosed method is an efficient surface treatment for grafting without a polymerization initiator or catalyst and Masuoka provides motivation by teaching the mechanism of graft polymerization by forming active seeds by plasma treatment to set the graft polymerization proceeding. This position is insufficient to meet the standard for motivation to combine. There is no suggestion or motivation to combine a reference specifically teaching the use of energized ion particles and simultaneous irradiation and gas infusion with references specifically teaching the use of plasma (which is different in terms of reaction patterns and reactants than treatment with ionic particles) and sequential irradiation and gas infusion found in the references themselves or in the state of the art. Moreover, with regard to the PTO's assertion of motivation to combine in Ohnishi, Ohnishi teaches that formation of a polymer radical on the substrate surfaces "by subjecting the substrate surfaces to a plasma treatment" (emphasis added) leads to efficient surface treatment (col. 4, line 9-14). Thus, there is no motivation to combine the disclosure of Ohnishi with a reference teaching the use of energized ionic particles, as opposed to a plasma, as in Publication No. 96-37742. The only basis for sequential irradiation with energized ionic particles and infusion of a reactive gas is applicants' combination of these elements and the unexpected results achieved by applicants' combination of these elements are set forth at Table 1 (page 14) of the specification. In the absence of any motivation in the art for such a combination, the combination is impermissible and should be withdrawn.

Moreover, the use of reactive gas as described in Publication No. 96-37742, as discussed on page 4 of the specification, is completely different than the use of gaseous hydrophilic monomers for graft polymerization, which are used in Ohnishi and Masuoka. In particular, a reactive gas is a gas having the capability to react with free radicals, which are formed on the polymer surface through the ion irradiation, thereby generating new functional groups. In contrast, the gaseous hydrophilic monomers for graft polymerization disclosed in Ohnishi and Masuoka can form free radicals within each of the monomers due to external environmental factors, so that such monomers are polymerized with each other. Thus, one of ordinary skill in the art would not be motivated to combine the disclosure of Publication No.

96-37742, relating to the use of a reactive gas, with the disclosures of Ohnishi or Masuoka, relating to the use of a gaseous hydrophilic monomer for graft polymerization.

Accordingly, the rejection based on Publication No. 96-37752, Ohnishi, and Masuoka is improper and should be withdrawn.

The rejection of claims 15, 17, 19-27, and 29-31 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,965,629 to Jung et al. ("Jung") in view of Ohnishi or Masuoka is respectfully traversed in view of the above amendments and the following remarks.

Jung relates to a process for modifying the surfaces of a polymer, ceramic, indium-tin-oxide (ITO), or glass by irradiating energized ion particles onto the surfaces of the polymer, ceramic, ITO, or glass while blowing a reactive gas directly over the surface of the polymer, ceramic, ITO, or glass under a vacuum condition.

It is the PTO's position that Jung teaches the method steps of the present invention, but does not specifically mention treating polymer membranes, polyolefin blends, or laminates. However, the PTO argues that it would have been obvious to one skilled in the art to employ polymers in the form of porous polymeric membranes, as disclosed by Ohnishi or Masuoka, as the polymer to be treated in the process disclosed by Jung. Moreover, the PTO argues that it would have been obvious to treat the irradiated polymeric surface in Jung with a gaseous monomer after irradiation (sequentially), as taught by Ohnishi or by Masuoka, instead of simultaneously, as disclosed by Jung. Applicants respectfully disagree.

As described above, a proper *prima facie* showing of obviousness requires the PTO to show that the prior art relied upon, coupled with the knowledge generally available to one of ordinary skill in the art, contains some suggestion which would have motivated the skilled artisan to combine or modify references. See In re Fine, 837 F.2d. 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988).

There is no suggestion or motivation in the above-noted references to combine the disclosure of Jung, which specifically discloses irradiating a polymer surface with energized ion particles while at the same time blowing reactive gas directly over the polymer surface, with Ohnishi or Masuoka which disclose irradiating a polymer membrane surface with a plasma and then supplying a gaseous hydrophilic monomer for graft polymerization. The PTO's position is that it would have been obvious to treat the irradiated polymeric surface of Jung with a gaseous monomer after irradiation (sequentially) in view of Ohnishi and Masuoka and that Ohnishi provides motivation by teaching that the disclosed method is an efficient surface treatment for grafting without a polymerization initiator or catalyst and

Masuoka provides motivation by teaching the mechanism of graft polymerization by forming active seeds by plasma treatment to set the graft polymerization proceeding. This position is insufficient to meet the standard for motivation to combine, as described above. There is no suggestion or motivation to combine a reference specifically teaching the use of energized ion particles and simultaneous irradiation and gas infusion with references specifically teaching the use of plasma (which is different in terms of reaction patterns and reactants than treatment with ionic particles) and sequential irradiation and gas infusion found in the references themselves or in the state of the art. In particular, Jung specifically teaches that "[w]hen the ion beam is irradiated, if a reactive gas is simultaneously introduced such as oxygen or nitrogen onto the surface where unstable chains the couplings of which are cleaved exits, a new polymer is formed due to a chemical reaction between the cleaved unstable chains and the reactive gases" (emphasis added) (see column 7, line 67 to column 8, line 5). Moreover, Jung teaches that "[f]or introducing the reactive gas or gases, it is advantageous that the reactive gas is blown directly onto that material surface simultaneously with the process of irradiating energized particles onto the metal surface" (see column 6, lines 8-12). Thus, the only basis for sequential irradiation with energized ionic particles and infusion of a reactive gas is applicants' combination of these elements and the unexpected results achieved by applicants' combination of these elements are set forth at Table 1 (page 14) of the specification. In the absence of any motivation in the art for such a combination, the combination is impermissible and should be withdrawn.

Moreover, the use of reactive gas as described in Jung is completely different than the use of gaseous hydrophilic monomers for graft polymerization, which are used in Ohnishi and Masuoka. In particular, a reactive gas (e.g., oxygen, hydrogen, nitrogen, carbon monoxide, or ammonia) is a gas having the capability to react with free radicals, which are formed on the polymer surface through the ion irradiation, thereby generating new functional groups (e.g., carbonyl, ester, hydroxyl, carboxyl, amino, or nitro) (see column 4, lines 45-56, column 7, line 59 to column 8, line 5, and column 8, lines 17-21 of Jung). In contrast, the gaseous hydrophilic monomers for graft polymerization disclosed in Ohnishi and Masuoka can form free radicals within each of the monomers due to external environmental factors, so that such monomers are polymerized with each other. Thus, one of ordinary skill in the art would not be motivated to combine the disclosure of Jung, relating to the use of a reactive gas, with the disclosures of Ohnishi or Masuoka, relating to the use of a gaseous hydrophilic monomer for graft polymerization.

Accordingly, the rejection based on Jung, Ohnishi, and Masuoka is improper and should be withdrawn.

The rejection of claims 15, 17, 19-27, and 29-31 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,783,641 to Koh et al. ("Koh") in view of Ohnishi or Masuoka is respectfully traversed in view of the above amendments and the following remarks.

Koh relates to a process for modifying a polymer surface by irradiating energized ion particles on the polymer surface, while blowing a reactive gas directly on the polymer surface under vacuum conditions.

It is the PTO's position that Koh teaches the method steps of the present invention, but does not specifically mention treating polymer membranes, polyolefin blends, or laminates. However, the PTO argues that it would have been obvious to one skilled in the art to employ polymers in the form of porous polymeric membranes, as disclosed by Ohnishi or Masuoka, as the polymer to be treated in the process disclosed by Koh. Moreover, the PTO argues that it would have been obvious to treat the irradiated polymeric surface in Koh with a gaseous monomer after irradiation (sequentially), as taught by Ohnishi or by Masuoka, instead of simultaneously, as disclosed by Koh. Applicants respectfully disagree.

As described above, a proper *prima facie* showing of obviousness requires the PTO to show that the prior art relied upon, coupled with the knowledge generally available to one of ordinary skill in the art, contains some suggestion which would have motivated the skilled artisan to combine or modify references. See In re Fine, 837 F.2d. 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988).

There is no suggestion or motivation in the above-noted references to combine the disclosure of Koh, which specifically discloses irradiating a polymer surface with energized ion particles while at the same time infusing reactive gas directly onto the polymer surface, with Ohnishi or Masuoka which disclose irradiating a polymer membrane surface with a plasma and then supplying a gaseous hydrophilic monomer for graft polymerization. The PTO's position is that it would have been obvious to treat the irradiated polymeric surface of Koh with a gaseous monomer after irradiation (sequentially) in view of Ohnishi and Masuoka and that Ohnishi provides motivation by teaching that the disclosed method is an efficient surface treatment for grafting without a polymerization initiator or catalyst and Masuoka provides motivation by teaching the mechanism of graft polymerization by forming active seeds by plasma treatment to set the graft polymerization proceeding. This position is insufficient to meet the standard for motivation to combine, as described above. There is no

suggestion or motivation to combine a reference specifically teaching the use of energized ion particles and simultaneous irradiation and gas infusion with references specifically teaching the use of plasma (which is different in terms of reaction patterns and reactants than treatment with ionic particles) and sequential irradiation and gas infusion found in the references themselves or in the state of the art. In particular, Koh specifically discloses that "[f]or introducing the reactive gas or gases, it is advantageous that the reactive gas is blown directly on the polymer surface simultaneously with the process of irradiating particles with energy on the polymer surface" (column 5, lines 62-65). Thus, the only basis for sequential irradiation with energized ionic particles and infusion of a reactive gas is applicants' combination of these elements and the unexpected results achieved by applicants' combination of these elements are set forth at Table 1 (page 14) of the specification. In the absence of any motivation in the art for such a combination, the combination is impermissible and should be withdrawn.

Moreover, the use of reactive gas as described in Koh is completely different than the use of gaseous hydrophilic monomers for graft polymerization, which are used in Ohnishi and Masuoka. In particular, a reactive gas (e.g., oxygen, hydrogen, nitrogen, carbon monoxide, or ammonia) is a gas having the capability to react with free radicals, which are formed on the polymer surface through the ion irradiation, thereby generating new functional groups (e.g., carbonyl, ester, hydroxyl, carboxyl, amino, or nitro) (see column 4, lines 19-29 and lines 43-52 of Koh). In contrast, the gaseous hydrophilic monomers for graft polymerization disclosed in Ohnishi and Masuoka can form free radicals within each of the monomers due to external environmental factors, so that such monomers are polymerized with each other. Thus, one of ordinary skill in the art would not be motivated to combine the disclosure of Koh, relating to the use of a reactive gas, with the disclosures of Ohnishi or Masuoka, relating to the use of a gaseous hydrophilic monomer for graft polymerization.

Accordingly, the rejection based on Koh, Ohnishi, and Masuoka is improper and should be withdrawn.

The rejection of claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Publication No. 96-37742, as discussed on page 4 of the specification, Jung, or Koh, each in view of Ohnishi or Masuoka as applied to claim 15, and further in view of Lazear is respectfully traversed in view of the above remarks.

In view of all of the foregoing, applicants submit that this case is in condition for allowance and such allowance is earnestly solicited.

Respectfully submitted,

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